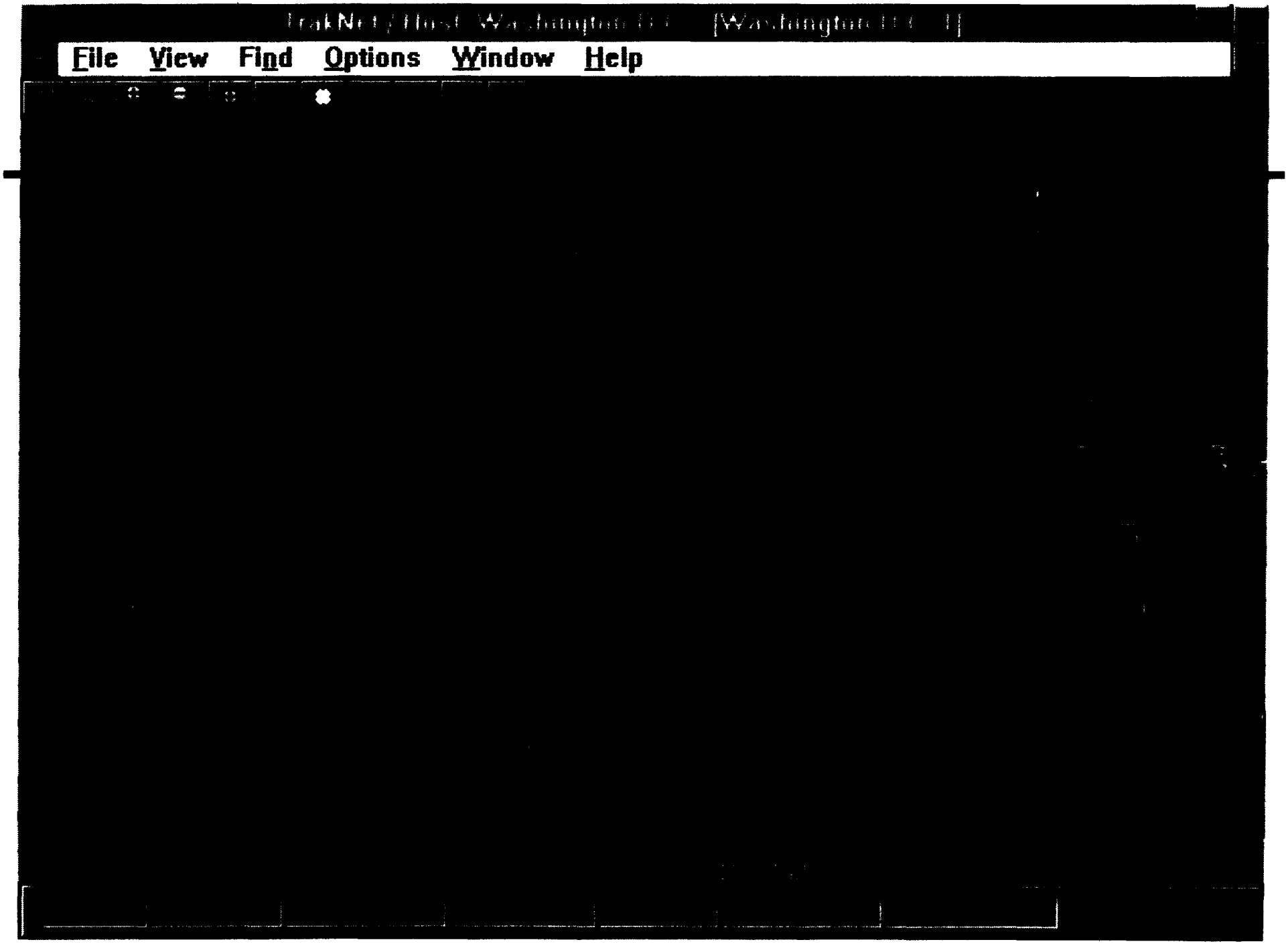
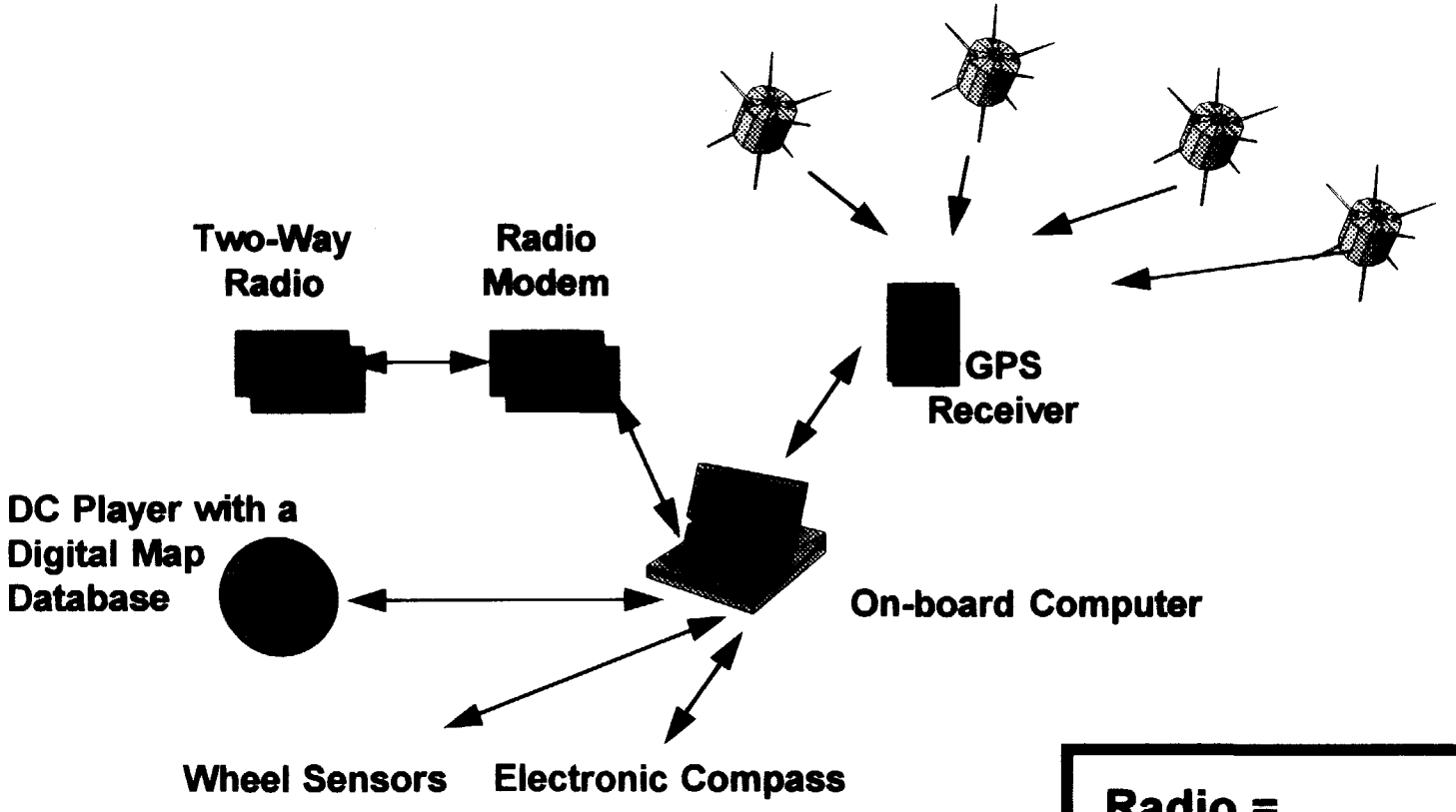

File View Find Options Window Help

GPS is Inefficient for Urban Vehicle Location Applications

- **Requires line-of-sight with 4 satellites**
  - Only 24 orbit the planet
  - Buildings and trees frequently block out line-of-sight
  - Long set up time (20 seconds to 2 minutes) for initial position-fix
- **Poor accuracy: 340 feet accuracy with 95% probability if in coverage (line-of-sight)**
- **Expensive differential GPS services can increase accuracy**
  - $10 to $40 per month; and accuracies vary
  - DoD is considering regulating differential GPS services for national security reasons
- **Only tells vehicle where it is located. No one else knows.**

Pinpoint Communications, Inc.
Ex Parte Presentation
PR Docket No. 93-61

GPS+Dead Reckoning+2 Way Radio+Modem+Airtime = Very Expensive and Inefficient Solution



Cost to xmit location =	$ 0.05 per location
Once a minute average =	$ 3.00 per hour
	$24.00 per day

Radio =	$ 500
Modem =	200
GPS Rec. =	500
Dead Reckoning =	1,500
Total Hardware =	$2,700

PINPOINT'S ARRAY™ WIDE-AREA AVM SYSTEM

- Designed to operate in the high-noise environment of the 902-928 MHz band
  - Can share with other wide-area systems
  - Can share with local-area AVM systems
  - Capable of tolerating significant level of Part 15 operations
- Designed to meet high-capacity needs of IVHS applications
  - Pinpoint can support IVHS initiatives requiring hundreds of vehicles to be located per hour
    - wide-area traffic monitoring and control
    - traveler information systems
    - public and private safety
    - mass transit systems management
  - Pinpoint can serve up to 3000 position fixes per hour in a metro area
    - 10-250 times more capacity than other wide-area AVM systems
    - Teletrac (35/second) would be consumed by needs of police department in medium-sized city
    - SW Bell (4-20/sec) would be exhausted by a moderately-sized taxi company
  - Accurate and high-capacity radiolocation is dependent on wide bandwidth
    - ameliorate severe multipath at bandwidths greater than 12 MHz
    - radiolocation rate increases significantly greater than increases in bandwidth
  - Ability to operate AVM over wide bandwidth on a time-shared basis will increase overall spectrum efficiency of the band as compared to narrower channelization

PINPOINT

WASHINGTON, DC

EXPERIMENTAL SYSTEM

FOR

AUTOMATIC VEHICLE MONITORING

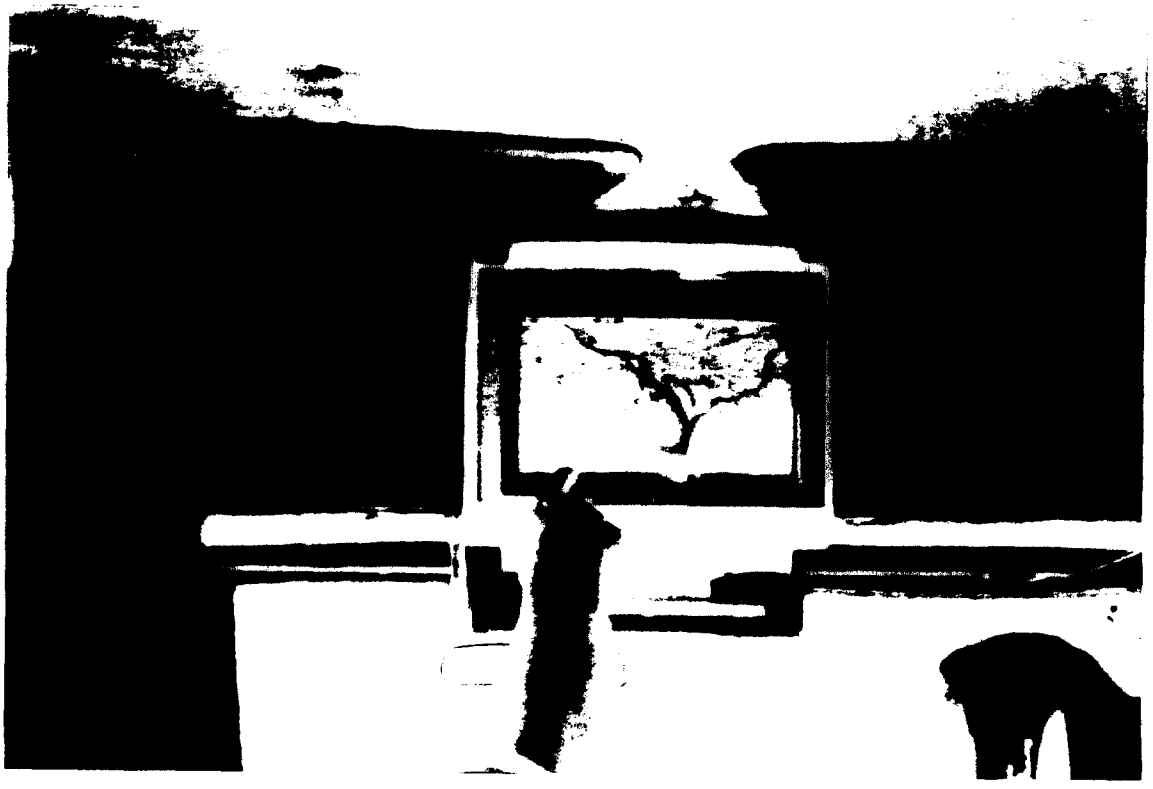
1993-1994

Pinpoint

Dispatching Center (left) and Map Display (right): Data Communications are Tracknet™ Capable

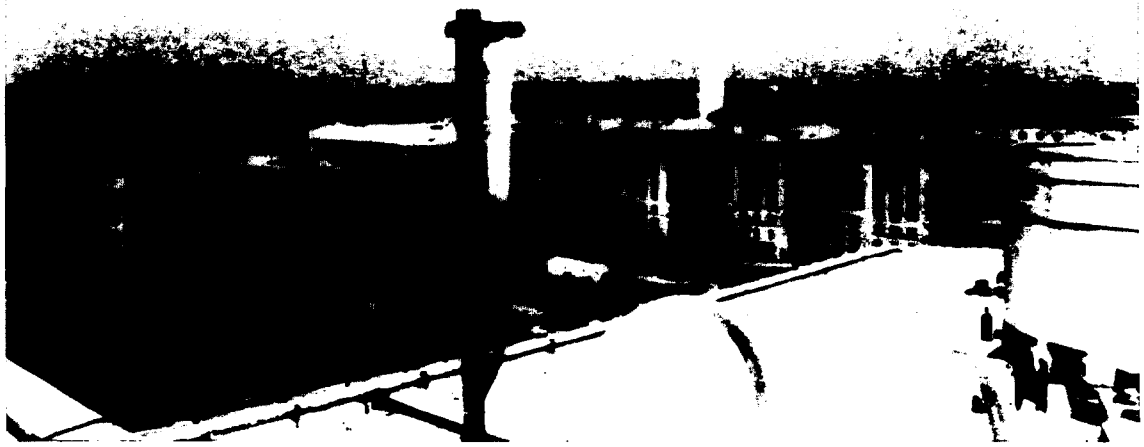
Experimental System Network Control Center

↑	↑	↑	↑
Diagnostic CPU	Navigation CPU	Scheduling Control	Data Communications CPU



Mobile Application Terminal (MAP) - TRACKNET™

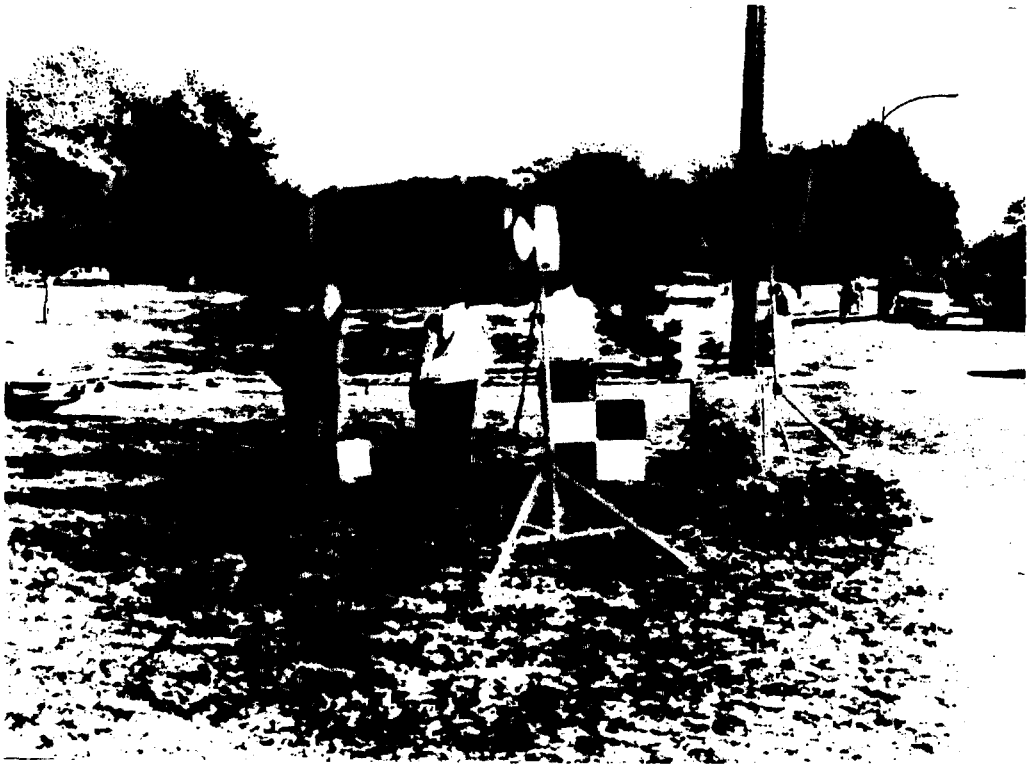
Mobile Demonstration Unit



Portals Site

Columbia Plaza Base Site

Views of Amtech Local Area AVM Compatibility Test



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CORPORATE PROFILE

Forcing change in the vehicle location and mobile data communications industry, Pinpoint™ Communications has invested more than three years of intensive research and development to create the first intelligent mobile data network. An intelligent mobile data network integrates automatic vehicle location with mobile data communications and offer revolutionary price performance over existing mobile technologies. Intelligent mobile data networks will dramatically change the way individuals communicate and manage business in a mobile environment. Pinpoint™ holds authorizations for automatic vehicle location sytems in seventeen of the largest metropolitan markets.

A pioneer in the mobile communications industry, Pinpoint recognizes the need for low-cost mobile data communications is basic and broad and is sparked by widespread commercial and consumer demand. The company's team of visionaries set out to fuel the changes required to meet the basic market needs and demands.

Pinpoint is based in Dallas and is a privately-held corporation heavily endowed by private technology investors that share in the vision of a nationwide intelligent mobile data network and the benefits it will provide in increased mobile management efficiency and elevated public safety. Pinpoint employs a technical staff of more than 30 engineers drawn from the land mobile communications and defense industries working to bring its ARRAY™ system to the public.

Pinpoint's ARRAY™ network overcomes previous price performance barriers and sets new standards for myriad of mobile applications. It achieves this by integrating the functions of mobile vehicle location and message delivery into a single, low-cost mobile communication hardware solution -- the TransModem™.

Pinpoint envisions applications that will enhance and further expand capabilities in the area of fleet management, vehicle security, emergency communications, mobile two-way messaging, mobile point-of-sale terminals and "smart car" systems that include traffic, direction and routing information all at the driver's fingertips in support of the Intelligent Vehicle Highway System.

Before the
Federal Communications Commission
Washington, D.C. 20554

GEN. Docket No. 87-389

In the Matter of

Revision of Part 15	RM-5193
of the Rules regarding	RM-5250
the operation of radio	RM-5575
frequency devices without an individual license.	

FIRST REPORT AND ORDER

Adopted: March 30, 1989; Released: April 18, 1989

By the Commission:

TABLE OF CONTENTS

INTRODUCTION

1. By this action, the Commission is amending Parts 2 and 15 of the Rules regarding the non-licensed operation of radio frequency (RF) devices and the equipment authorization procedures associated with this equipment.

with the comments that a limit on maximum output power over a specified frequency range is a more appropriate standard for this type of equipment. Accordingly, we are adopting a power output limit of 10 watts over the frequency range 9-45 kHz and one watt over the frequency range 45-490 kHz, as proposed by Dynatel. In addition, we are requiring cable locating equipment to comply with the AC power line conducted emission limits for those devices that connect to the AC power line.

3. New Bands

55. In the *Notice*, we proposed to authorize the operation of Part 15 devices on a number of new frequency bands, namely the frequency bands allocated to industrial, scientific and medical (ISM) devices, [19] at higher emission levels. These frequency bands are: 13.553-13.567 MHz, 26.96-27.28 MHz, 40.66-40.70 MHz, 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24.0-24.25 GHz. As under the general limits, operation within these bands would not entail restrictions on channelization, bandwidth, type of modulation, or type of operation. The Commission stated that establishment of these new bands would enable manufacturers to introduce new equipment providing major benefits to consumers and to take advantage of new technologies without the need for Commission rule making.

56. A number of commenters object to permitting the operation of Part 15 devices on ISM frequency bands. FAA indicates that allowing operation of Part 15 devices on the ISM bands is a disservice to the public, as there are many Government and commercial operations with high powered transmissions within and adjacent to these bands. FAA states that ISM bands allocated to the government should not become locations for concentrations of Part 15 devices. Other comments, such as those of Allen-Bradley and GE, express the belief that such a large number of Part 15 users might operate on the ISM bands that the Commission might decide to implement restrictions on authorized ISM users to protect the operators of Part 15 devices from interference. The League and individual ARS operators object to allowing Part 15 devices within ISM frequency bands allocated to the Amateur Radio Service, citing the possibility of interference both to and from Part 15 operation. [20]

57. GM, on the other hand, supports the use of the proposed new bands by Part 15 devices. GM states that the FCC should leave the decision of whether any high power transmission, be it from ISM equipment, U. S. Government systems, or amateur radio, will cause interference to a Part 15 device to the manufacturer and its engineering staff. SEIA, in its comments, states that Part 18 devices are allowed unlimited radiation in the ISM bands, and, since both Part 18 and Part 15 devices are regulated to protect authorized services, these devices should be treated similarly with respect to emission limits. Other comments from the manufacturers of control and security alarm devices request that a new classification be established under Part 15 to permit higher emissions levels for Part 15 devices located in industrial, commercial or business establishments. They indicate such an approach would be similar to the differentiation between Class A and Class B computers. [21] In support of this approach they indicate that spurious emissions from transmitters in the authorized radio services are now permitted at higher levels than emissions from Part 15 devices. NTIA responds to these comments by stating that the number of transmitters in the authorized services is a small fraction of the number of Part 15 devices. NTIA also states that interference from a licensed transmitter generally can more easily be traced and eliminated than interference from Part 15 devices because the frequency and location of a licensed station are ordinarily known, whereas it is more difficult and expensive to locate and eliminate a multitude of Part 15 devices.

58. We continue to believe that there are many possible applications for Part 15 devices within these ISM bands. The fact that these frequencies may not be suitable for certain consumer devices is not a reason to prohibit Part 15 operation. We note that presently there are many Part 15 applications that are tolerant of interference or isolated from potential interference sources. We believe that manufacturers, if given the opportunity to use the ISM frequencies, will develop many new and practical uses of Part 15 devices. Thus, we will not restrict the use of these bands by Part 15 equipment because of the possibility of interference to that equipment by equipment operating under other rule parts.

59. We also believe that the probability that Part 15 operations will cause interference to authorized services in the ISM bands above 900 MHz is low. First, the rate at which radiated emissions are attenuated, especially from intervening objects, is quite high in these bands. Second, the potential for the Part 15 device to receive interference is much greater than the potential for the Part 15 device to cause interference. Because of the possible applications which exist for viable uses of these bands, the proposed rules are being implemented.

60. As for requests from SEIA that Part 15 devices be permitted to operate with additional field strength in the bands allocated for ISM operation under Part 18, we note that Part 18 is an authorized service. Part 18 devices are permitted to radiate without a limit on the level of radiation only in those frequency bands in which ISM operation is the primary authorized service. Part 18 devices operated in this manner are not required to provide any protection from interference to other authorized services located within the ISM bands. For this reason and the potential for such Part 15 devices to cause interference to authorized radio services located in the ISM bands, we are denying SEIA's request. Further, we find that the request by the manufacturers of control and security alarm devices to establish a special classification under the Part 15 rules permitting higher emissions is beyond the scope of this proceeding. We also note that, in many instances, the need for higher emissions levels can be met through operation under one of the authorized services. In view of the absence of interference protection for Part 15 devices, it would appear that, wherever possible, operation under the authorized services would be preferable to operation under the Part 15 rules. We therefore encourage parties with need to operate RF equipment at higher emissions levels than those permitted herein to seek authorization under other provisions of our rules.

4. Restricted Bands

61. *Frequency Bands Designated as Restricted.* In the *Notice*, we proposed to prohibit the operation of Part 15 intentional radiators on the frequencies used by certain sensitive radio services, i.e., frequency bands allocated for services involving safety-of-life or for services that utilize very low received signal levels. [22] These proposed restricted bands were coordinated with the NTIA prior to

Pinpoint

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What Is IVHS?

IVHS

Intelligent Vehicle-Highway Systems. Complementary technologies encompassing information processing, communications, control, and electronics combined to improve transportation in the United States.

IVHS America

IVHS America is a non-profit educational and scientific association that plans, promotes and coordinates the development of intelligent vehicle-highway systems in the United States. The association is a federal advisory committee to the U.S. Department of Transportation.

Membership

Pinpoint is a private member company of IVHS America, along with other transportation, communications and electronics industry members. Other members include local, state and federal government agencies, academic institutions and related associations.

Action

The 1991 Intermodal Surface Transportation Efficiency Act (ISTEA) was enacted to "develop a national intermodal transportation system that is economically sound, provides the foundation for the Nation to compete in the global economy, and will move people and goods in an energy-efficient manner." IVHS is the only way to achieve this goal.

IVHS Goals

- Improved Safety
- Reduced Congestion
- Increased and Higher Quality Mobility
- Reduced Environmental Impact
- Improved Energy Efficiency
- A viable U.S. IVHS Industry

IVHS Areas

- Advanced Traffic Management Systems (ATMS)
- Advanced Traveler Information Systems (ATIS)
- Advanced Vehicle Control Systems (AVCS)
- Commercial Vehicle Operations (CVO)
- Advanced Public Transportation Systems (APTS)

Making it Happen

Building more roads and expanding existing roads is only part of the answer. We must use the roads we have more effectively. The flight to suburbia has reached its maximum commutable tolerance. The environment and air quality continue to suffer from clogged roadways. Public transportation, which is a viable alternative, remains largely unattractive to drivers and often has a limited metropolitan reach. Commercial vehicles that carry this country's goods are being slowed down by traffic congestion, weigh stations, tolls, excessive paperwork and are unable to communicate with a home base most of the time.

Technology Designed With IVHS in Mind

Pinpoint has the only functional communications solution at the price point needed to make IVHS a widespread reality. Pinpoint's founders designed the ARRAY™ network with IVHS in mind.

Advanced Traffic Management Systems (ATMS)

ATMS is the building block of all IVHS functional areas. It will collect, use and disseminate real-time data on congested arterial streets and expressways and will alert transit operators of alternative routes. Dynamic traffic control systems will respond to changing traffic conditions across different jurisdictions and types of roads by routing drivers around delays where possible. Rapid detection of response to traffic incidents will be especially effective in reducing congestion on expressways.

Existing Technology in Use Today

Loop Detectors
Closed Circuit TV
Signpost
Global Positioning System (GPS)
Narrowband Two-Way Radio

Drawbacks to Existing Technology

Existing Approaches Impractical

- Cost and infrastructure investment impractical
- Existing two-way communications options too costly and performance and capacity are limited
- Installation effort mammoth

Pinpoint's Solution

- Integrated vehicle location and communications function over a single network
- Real-time traffic monitoring
- Two-way, high-speed data communications
- Integrated Automatic Vehicle Location
- Responsive Demand Management
- High subscriber capacity

Advanced Traveler Information Systems (ATIS)

ATIS provides information that assists travelers in reaching a desired destination via private vehicle, public transportation or a combination of the two. On-board navigation systems are an ATIS building block. Information will include locations of incidents, weather and road conditions, optimal routes, recommended speeds and lane restrictions.

Existing Technology in Use Today

Communication

One-way paging
Cellular
Specialized Mobile Radio (SMR)

Location/Navigation

Global Positioning System (GPS)
Dead Reckoning
On-board Navigational Computer

Drawbacks to Existing Technology

Existing Approaches Impractical

- Transmission is not fast enough, nor is there adequate bandwidth
- Far too expensive — the driver won't pay
- Locating function unreliable for urban IVHS applications
- Cost of air time and vehicle equipment too high
- There is no integrated location function
- The architecture is inefficient for IVHS requirements
- There is simply not enough system capacity to handle the messaging requirements of ATIS.

Pinpoint's Solution

- Integrated vehicle location and communications function over a single network
- Integrated AVL function that penetrates urban areas
- Navigation without GPS or signpost
- Two-way, digital data communications that is spectrum efficient
- High-volume message handling capability
- High-speed data transmission
- Fully automated emergency alert

Commercial Vehicle Operations (CVO)

Commercial Vehicle Operations are intended to improve the safety and efficiency of commercial vehicle and fleet operations. CVO, as part of IVHS, will increase driver safety, expedite deliveries, improve operation efficiency, improve incident response and decrease operational costs.

Existing Technology in Use Today

Communication

One-way Paging
Cellular
Specialized Mobile Radio (SMR)
Low Earth Orbiting Satellites (LEO)

Location/Navigation

Global Positioning System (GPS)
Dead Reckoning
On-board Navigational Computer

Drawbacks to Existing Technology

Existing Approaches Impractical

- Use of LEO and other satellite communications is very expensive and is unreliable in urban areas
- Cellular, SMR are costly and inefficient for widespread CVO
- Satellite-based/GPS services are unreliable in urban areas
- In-vehicle equipment and other network components are expensive with satellite-based service

Pinpoint's Solution

- Integrated vehicle location and communications function over a single network
- Efficient use of spectrum
- High capacity, low cost
- Accurate vehicle location in severe urban multipath environments
- Low-cost, in-vehicle equipment

Advanced Public Transportation Systems (APTS)

APTS applies advanced electronic technologies to the deployment and operation of high-occupancy, shared-ride vehicles such as conventional buses or rail service. Technologies from ATMS and ATIS in the area of communications, navigation and advanced information systems are applied to APTS. Developments in ATMS and ATIS will improve mass transportation services and will be used to inform travelers in real time of alternative schedules, costs or the most advantageous routing, for example.

Existing Technology in Use Today

Communication

- One-way Paging
- Cellular
- Specialized Mobile Radio (SMR)

Location/Navigation

- Global Positioning System (GPS)
- Dead Reckoning
- On-board Navigational Computer

Drawbacks to Existing Technology

Existing Approaches Impractical

- Communications and location functions via satellite are unreliable in urban areas
- High cost
- Communications and location infrastructure is costly and arduous to implement
- Spectrum and capacity limitations

Pinpoint's Solution

- Integrated vehicle location and communications function over single network
- Accurate location in urban areas
- Two-way, real-time, cost-effective data communications and location monitoring
- Driver assistance and security functions
- Fleet monitoring information
  - Integration of computer dispatch, customer information and security functions